

REMARKS

The Applicants thank the Examiner for the careful examination of this application.

Claims 1 – 7 are pending and rejected. This Amendment is submitted to respond to the Examiner's Office Action dated 1/14/03 and to prepare this case for appeal.

Claim 1 positively recites the formation of a coating comprising a dopant over a surface of the semiconductor substrate and heating the semiconductor substrate to cause a portion of the dopant to diffuse from the coating into the semiconductor substrate. In addition, Claim 1 positively recites that the impurity atom is a faster diffusing species relative to silicon atoms. These advantageously claimed features are not taught or suggested by the patents granted to Lee ('337) or Lee ('640), either alone or in combination.

The Applicants respectfully traverse the assertion in the Office Action that Lee ('337) discloses "forming a coating comprising a dopant over a surface of the semiconductor substrate". The Office Action claims that column 2, lines 43-65 of Lee ('337) supports that assertion. However, in column 2, lines 43-65, Lee teaches that the coating is a photoresist film and not a coating comprising a dopant (col. 2, lines 49 and 53). Furthermore, in column 2, lines 43-65 Lee teaches away from the advantageously claimed invention because Lee teaches that the dopant is ion implanted (col. 2, lines 50, 62, and 67).

Lee ('640) also teaches away from the advantageously claimed invention of diffusion from the coating because Lee ('640) also specifically teaches the formation of the P-N junction by ion implantation (col. 3, lines 40-45, see also col. 6, lines 48-58). Lee ('640) further teaches away from the advantageously claimed invention because Lee ('640)

uses heavy ions, such as Si, Ge, As, (col. 6, lines 3-5) instead of the advantageously claimed impurity atom that is a faster diffusing species relative to silicon atoms (i.e. fluorine, chlorine, nitrogen, or carbon).

Therefore, Claim 1 is patentable over Lee ('337) and Lee ('640), either alone or in combination. Furthermore, Claims 2 - 7 are allowable for depending on allowable independent Claim 1 and, in combination, including limitations not taught or described in the references of record.

The Applicants respectfully traverse the assertion in the Office Action that it "would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Lee ('337) by incorporating an ion dosage of about 1×10^{13} atoms/cm², to avoid short channel effects in forming the ultra shallow junctions". The Applicants submit that this assertion is illogical because the Applicants impurity atom is fluorine - not a dopant. Therefore it cannot help with short channel effects. Furthermore, the dose cited in the quoted statement is nonsensical.

The Applicants also respectfully traverse the assertion in the Office Action that it "would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Lee ('337) by incorporating an impurity ion dosage at about 1×10^{14} atoms/cm²; a diffused region is located about 50nm from the surface; dopant concentration is at about 1×10^{18} atoms/cm², to obtain an abrupt change in the slope of the dopant profile at the shallow junctions. The Applicants submit that the abruptness of the junction is defined by the nature of the diffusivity of boron in silicon. Therefore, current technologies are all limited by this maximum slope (ranging from 5-

10 nm/dec) However, the use of the advantageously claimed fast diffusing species like fluorine provides a means to go beyond this limit. Thus, the Applicants' invention achieves an abruptness that is much better than what is possible through the teachings of Lee ('337) or Lee ('640) - who don't teach the use of impurity atoms such as fluorine.

For the reasons stated above, this application is believed to be in condition for allowance. Reexamination and reconsideration is requested.

Respectfully submitted,



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